NOAA FISHERIES

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Overview of SEFSC Assessments

HMS Sharks: Atlantic sharpnose shark case example (SEDAR 34)

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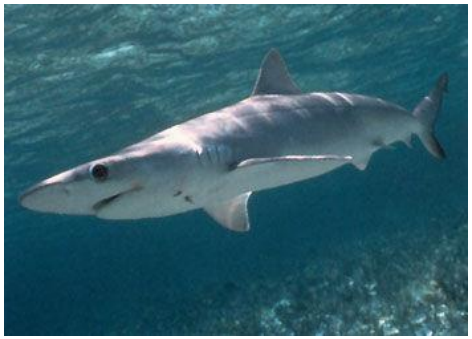
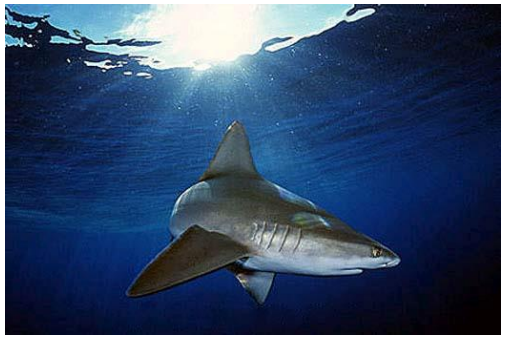
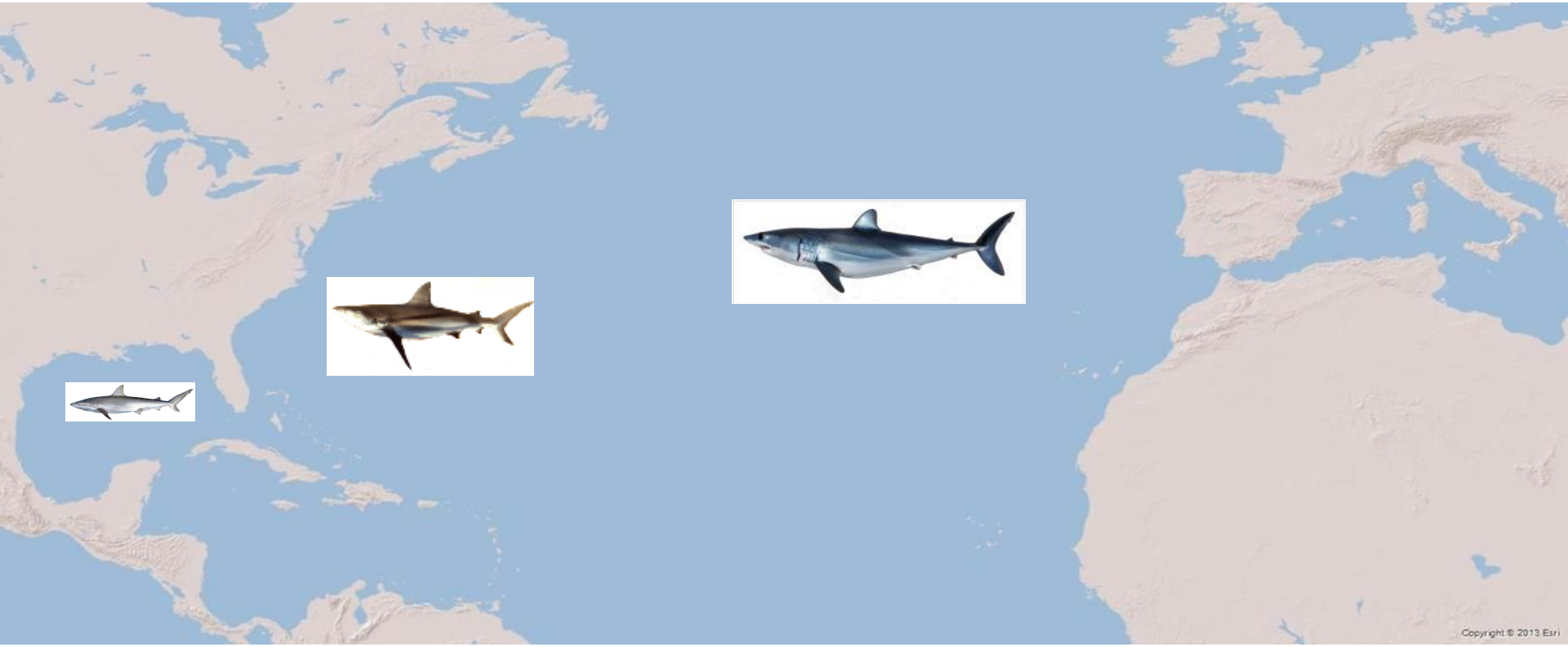




Outline

- Species covered
- Staff and organization
- Steps in process
- Assessment history
- Data inputs and models
- Data and modeling limitations
- Characterization of uncertainty
- Management
- Documentation and other products
- Summary

Managed stocks



- All sharks managed by HMS in the USA
- 39 species managed in FMP
  - Small coastal sharks (4)
  - Large Coastal sharks (11)
  - Pelagic sharks (5; managed by ICCAT)
  - Prohibited species (19)

- Only 11 species assessed (13 stocks); of those 5 overfished and 3 undergoing overfishing
- Atlantic sharpnose shark first assessed in 2002
- Shark assessments are data-moderate in general

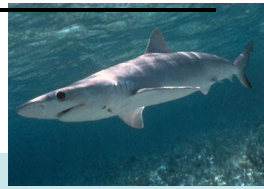
Current Stock Assessment Staff and Organization in SEFSC Panama City Laboratory (FL)

- 2 stock assessment analysts (SAAs)
- 1 new stock assessment analyst (co-analyst on first assessment currently)
- Other assessment support (indices of abundance; observer data)
- No support person to help with data compilation and preliminary analyses

Schematic of activities conducted for SEDAR 34 (standard; Atlantic sharpnose shark only)

ACTIVITY	DEC 12	JAN 13	FEB 13	MAR 13	APR 13	MAY 13	JUN 13	JUL 13	AUG 13	SEP 13	OCT 13	NOV 13	DEC 13+
	MONTH												
BEFORE ASSESSMENT													
Work on TORs, schedule													
Identify participants													
Scope data													
Compile catch													
Compile length comps													
Develop abundance index(ices)													
Estimate shrimp trawl bycatch													
Estimate longline (gillnet) bycatch													
Compile/analyze life history info													
DURING ASSESSMENT													
Characterize uncertainty: catches													
Characterize uncertainty: biology													
Estimate M and productivity													
Estimate selectivities													
Trend/correlation analysis indices													
Conduct assessment/projections													
Prepare analyses/presentations for webinars													
AFTER ASSESSMENT													
Report writing and revisions													
Post-CIE review analyses and updates													
Responses to HMS Division requests													
Presentation of results to AP and others													
Enter results into SIS													

Lead SA analyst
Support SA analyst
Support SA analyst (2)
Support biologist



Overview of models used in HMS shark stock assessments, 1998-present

STOCK	YEAR												
	1998	2002	2004	2006	2007	2008	2009	2010	2011	2012	2013	2014
LCS complex	BSP	BSP; SS-SPM; SS-LRSG		BSP; SS-SPM								
Sandbar	BSP	BSP; SS-SPM; SS-LRSG; SS-ASPM; MLE		ASPM; BSP; SS-SPM				ASPM				
Blacktip	BSP	BSP; SS-SPM; SS-LRSG; SS-ASPM; MLE								ASPM		
SCS complex		BSP; SS-SPM; SS-LRSG			BSP; SS-SPM							
Atlantic sharpnose		BSP; SS-SPM; SS-LRSG			ASPM; BSP; SS-SPM						ASPM	
Bonnethead		BSP; SS-SPM; SS-LRSG			ASPM; BSP; SS-SPM						ASPM	
Blacknose		BSP; SS-SPM; SS-LRSG			BSP; SS-SPM							
Finetooth		BSP; SS-SPM; SS-LRSG			BSP; SS-SPM							
Blacktip (GOM)				ASPM; BSP; SS-SPM								
Blacktip (ATL)				ASPM; BSP; SS-SPM								
Dusky				ASPM; CFASM; BSP; SS-SPM; ASM				CFASM				
Blue			BSP; ASPM			BSP; CF-ASPM; ASM						
Shortfin mako						BSP; CF-ASPM; ASM				BSP; CF-ASPM		
Porbeagle							BSP; CF-ASPM; ASPM					
20 pelagic stocks										ERA		
Scalloped hammerhead								SPM				
Blacknose (GOM)								ASPM				
Blacknose (ATL)								ASPM				
Smooth dogfish												SS3; BSP
Smoothhound complex												SS-SPM; BSP

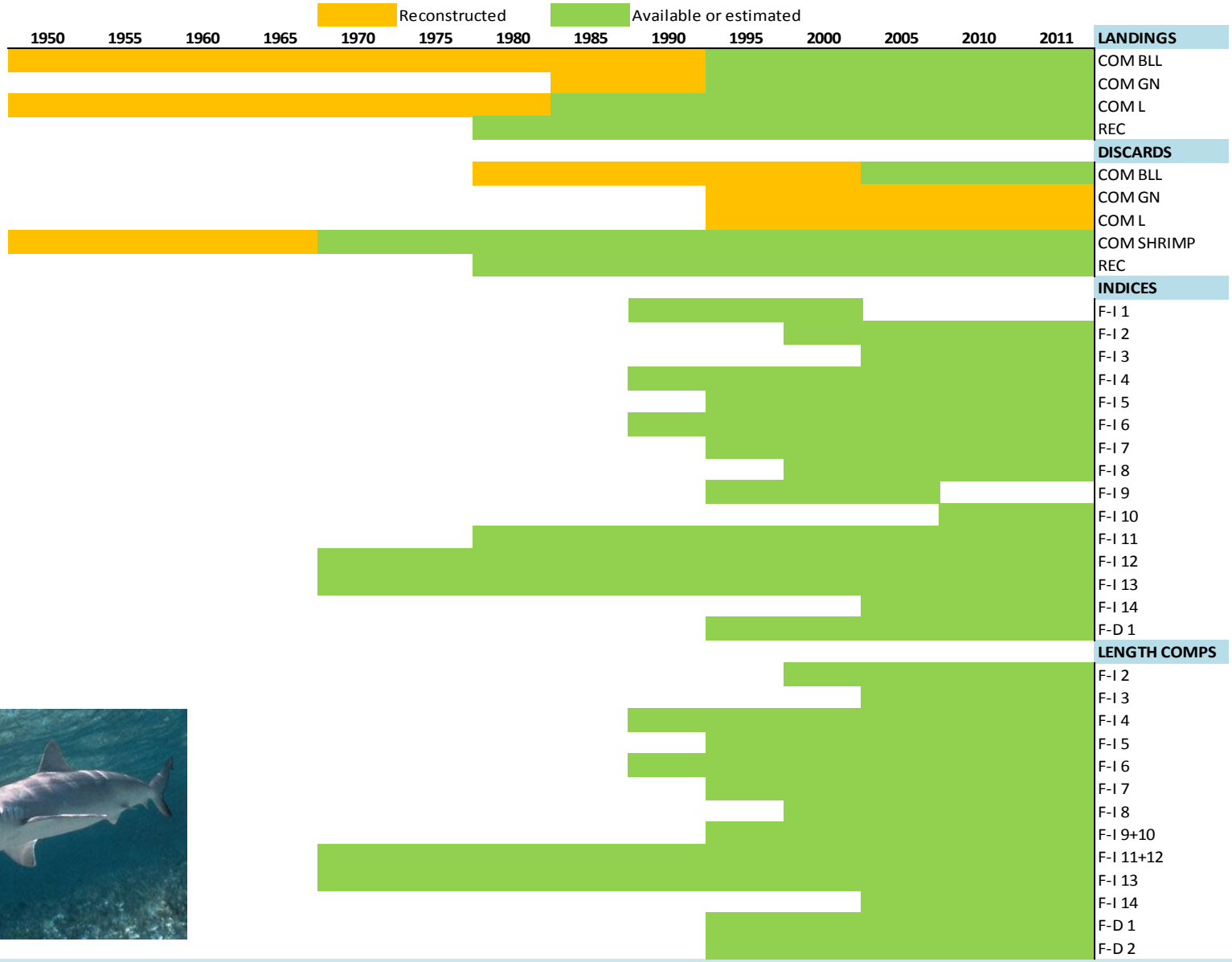
BLUE =ANALYST 1	Remains	ASM	Age-Structured
RED =ANALYST 2	Left	ASPM	Age-Structured Production
GREEN =ANALYST 3	External	BSP	Bayesian Surplus Production
BROWN =ANALYST 4	External	CF-ASPM	Catch-Free Age-Structured Production
PURPLE =ANALYST 5	Left	ERA	Ecological Risk Assessment
DARK RED=EXTERNAL	External	MLE	"Maximum Likelihood Estimation"
BLACK=ANALYST 6	Left	SS-LRSG	State-Space Bayesian Lagged Recruitment, Survival and Growth
PINK=ANALYST 7	New	SS-SPM	State-Space Bayesian Surplus Production
		SS3	Stock Synthesis 3

History of HMS Shark Stock Assessments:
Atlantic sharpnose shark case example

Assmt. Year	Name	Type	Stocks	Duration (mo.)	Peer reviews	SAPA
1998	SEW 1998	SEW	LCS complex, Sandbar, Blacktip	9	3 CIE + 4 NRC	0.6
2002	SEW 2002	SEW	LCS complex, Sandbar, Blacktip	6	3 CIE	1.0
2002		**In-house**	SCS complex, **Atlantic sharpnose**, Bonnethead, Blacknose, Finetooth	**10**	**1 SEFSC**	**5.0**
2004	ICCAT	SCRS	Blue	2	1 independent	0.5
2006	SEDAR 11	Benchmark*	LCS, Sandbar, Blacktip (GOM), Blacktip (ATL)	12	3 CIE + 2 independent	1.0
2006		In-house	Dusky	12	2 NEFSC	0.3
2007	**SEDAR 13**	**Benchmark***	SCS complex, **Atlantic sharpnose**, Bonnethead, Blacknose, Finetooth	**10**	**3 CIE**	**1.7**
2008	ICCAT	SCRS	Blue, Shortfin mako	2		1.0
2009	ICCAT-ICES	SCRS	Porbeagle	2		1.5
2010		External	Scalloped hammerhead		1 SEFSC	1.0
2011	SEDAR 21	Benchmark	Sandbar, Dusky, Blacknose (GOM)	20	5 CIE	1.0
2012	SEDAR 29	Standard	Blacktip (GOM)	9	2 CIE	1.0
2012	ICCAT	SCRS	Shortfin mako, 20 pelagic stocks	4		1.0
2013	**SEDAR 34**	**Standard**	**Atlantic sharpnose**, Bonnethead	**13**	**3 CIE**	**1.0**
2014	SEDAR 39	Benchmark	Smooth dogfish, Smoothhound complex	16**	3 CIE	0.7
Mean (SEDARs)				12.8	3.5	1.1
Mean (pre-SEDAR)				8.3	3.7	**2.2**
Mean (ICCAT)				2.5	0.25	1.0
Overall mean				8.5	3.3	1.2

* SEDAR-like process
** Ongoing
SAPA=Stocks Assessed per Analyst

Data availability for Atlantic sharpnose shark by year and type



Stock Assessment Models Used for Atlantic sharpnose sharks

- Models used have evolved according to data availability
- Initially different types of ***production models*** (that considered observation error only or process and observation error models)
- Followed by ***delay difference model*** with some additional data requirements
- Most stocks assessed, including this one, more recently with ***age-structured production model***

Evolution of Stock Assessment Models Used for Atlantic sharpnose sharks

Surplus Production Models

- Aggregated catch
- Abundance indices

Delay-difference Models

- Aggregated catch
- Abundance indices
- Some biological data (survival, growth)
- Stock-recruit relation

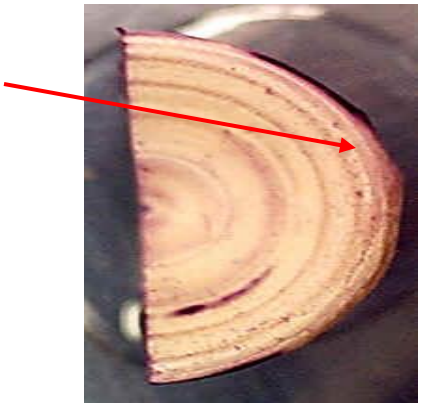
Age-structured Production Models

- Catch by gear type
- Abundance indices
- Gear selectivity parameters
- Biological parameters:
  - Natural mortality at age
  - Maximum age
  - Age at maturity
  - Sex ratio at birth
  - Number of pups at age
  - Proportion of reproductively active females at age
  - Length-weight relationships
  - Growth function parameters

Complexity
Data requirements
Estimable parameters

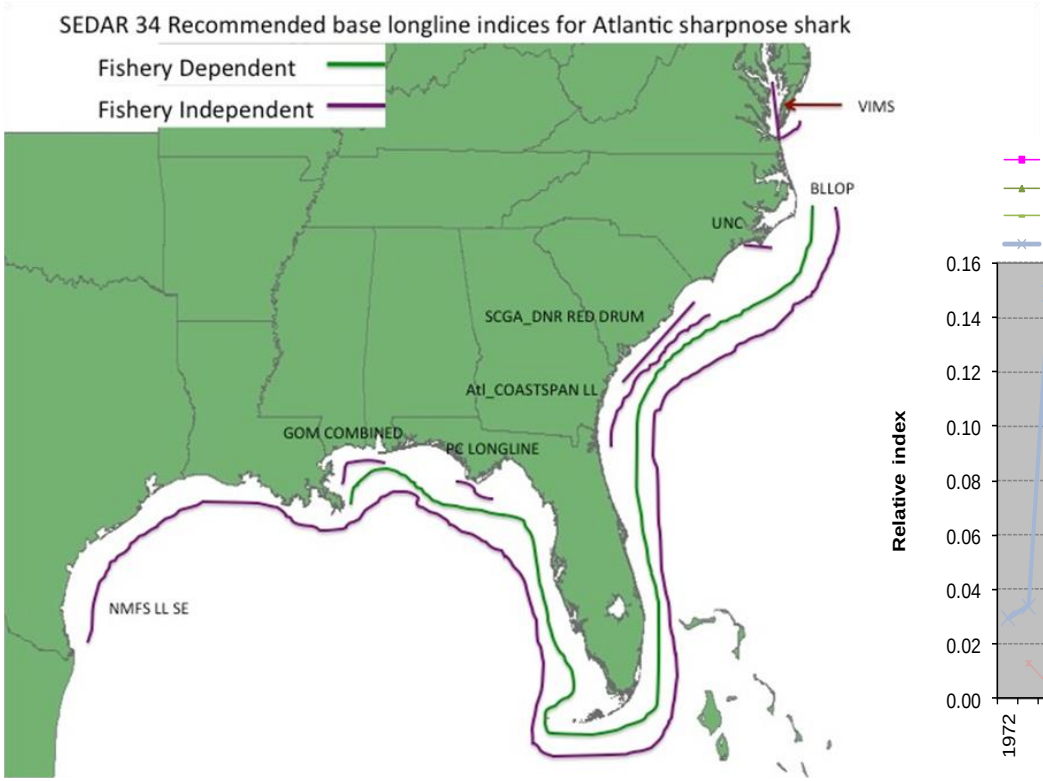
Key Data Limitations (applicable to most species)

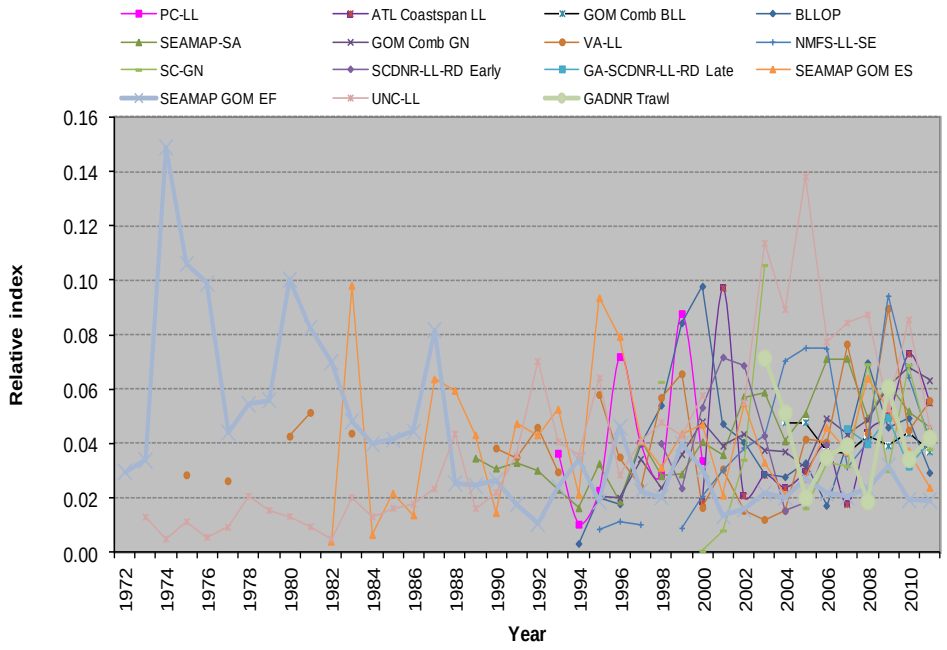
- Improve quality of catch estimates in general (particularly bycatch estimates and recreational catches)
- Limited length compositions and *lack* of age compositions
- Biology:
  - Improve/develop age and growth model estimates, more validation needed
  - Improve knowledge on breeding frequency



Key Data/Modeling Limitations

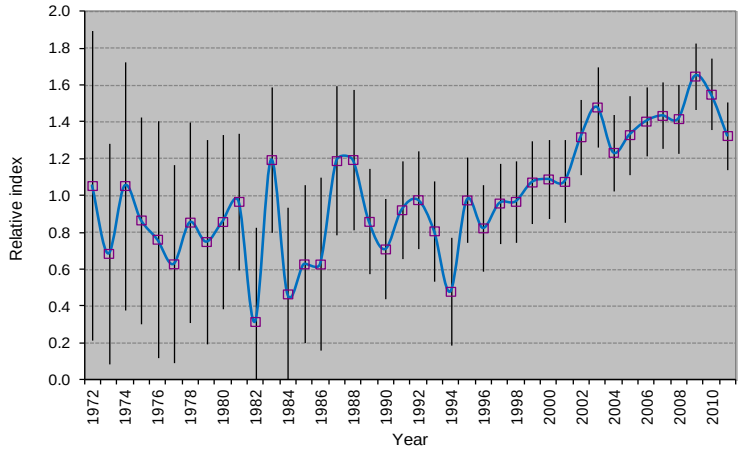
- Multiple indices of abundance generally available, but often with conflicting signals that create tensions in model





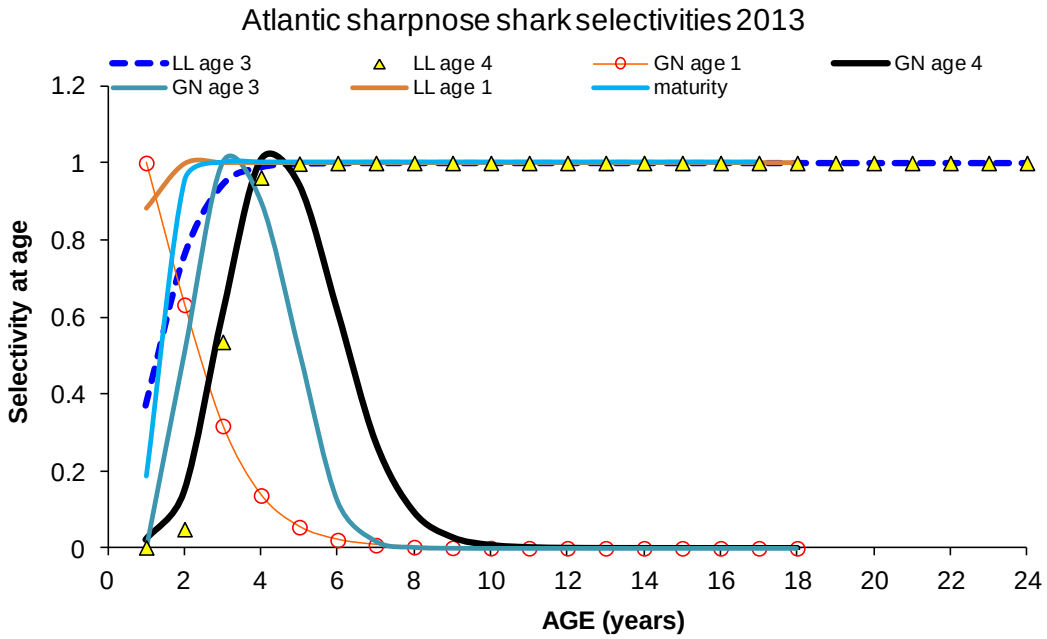
Some solutions: Hierarchical abundance index (Conn 2010)

- One single combined index of relative abundance is estimated
- Assumes that each index is attempting to estimate relative abundance, but is subject to both sampling and process error
- Sampling error assumed to be captured by previous standardization of indices (via CVs)
- Each index also subject to process variation, which describes the degree to which a given index measures "artifacts" above and beyond relative abundance in the population



Key Data/Modeling Limitations

- Selectivities generally estimated externally to the model after conversion of lengths into ages through growth curve or an age-length key



Characterization of Uncertainty

- Uncertainty in Data inputs (through Sensitivity Analysis)
  - Catches
  - Biological parameters
  - Indices of abundance
- Observation error in indices of abundance
- Process error in stock-recruit relationship
- Model uncertainty
  - Model complexity
  - Model structure
- Estimation uncertainty
  - Algorithm; Likelihood profiling
  - Buffer between ABC and OFL
- Implementation uncertainty
  - ACL, ACT set by managers

Management Actions (General)

- HMS has no SSC

- For upper-tier stocks (data-moderate in the case of sharks), have developed a P*-like projection approach to provide a buffer between ABC and OFL in situations where the stock is not overfished

- If stock is overfished, then rebuilding rules apply

- No formal Harvest Control Rules for lower-tier stocks have been developed. Average catch over past few years is used; other species are Prohibited

Documentation (working papers, reports, and presentations generated during a typical SEDAR cycle)

- **Data Workshop documents** (PCL stock assessment analysts (SAA), other PCL shark staff, Miami Lab staff, MS Labs shark staff, and NEFSC shark staff): 41+4 docs / 45+25 docs
- **Data Workshop report** (PCL SAAs)
- **Stock Assessment Process documents** (PCL SAAs; 6 docs)
- **Stock Assessment Report** (PCL SAAs; 298 pp / 459 pp)
- **Post-review update and revisions document** (PCL SAAs; 42 pp / 18 pp)
- **Webinar presentations** (5 webinars for Atlantic sharpnose shark [standard assessment; SEDAR 34]; but 21 webinars for HMS sandbar shark [benchmark assessment; SEDAR 21)
- **Assessment summary document** (benchmark assessments, 17 pp; PCL SAAs;)
- **Presentations for AP meetings or other** (PCL SAAs)

Summary: challenges

- Process:
  - Too long and cumbersome, results in low assessment throughput/effort
  - Analyst time for research, keeping up with field, and creativity is extremely limited: high burnout rate
  - HMS lacks an SSC
- Data limitations: uncertain catch, lack of age compositions

Summary: positives

- Process:
  - Open process
  - Products highly scrutinized
- Modeling:
  - Could apply data-poor/data-moderate methods to more species, but need more streamlined process